KI isn't a "silver bullet," says Steve Unglesbee, a spokesman for the Nuclear Energy Institute in Washington, DC, because it can create a false sense of security as well as "ambiguity through choice." Unglesbee likes to quote an April 1997 Chicago Sun-Times editorial that argued against stockpiling: "The idea is akin to putting a dab of sunblock on your nose at the beach; you may end up with a protected prow, but the rest of your body will be scorched."

But supporters of stockpiling, including the American Thyroid Association, contend that it would be negligent of the industry and of state and federal governments not to endorse what they call a simple and cheap insurance policy. "I compare it to lifeboats and life jackets on a ferry," says Peter Crane, a staff attorney for the NRC and a long-time advocate for the tablets' use. "It's better to be evacuated in a lifeboat, but also helps to have on a life jacket."

The tablet works by saturating the thyroid with iodide, which the organ needs to make hormones needed by the nervous system and brain. A saturated thyroid will not, therefore, absorb cancer-promoting radioactive iodide that may escape into the air from a nuclear power plant's containment facility during a nuclear accident. Crane has been leading the effort to stockpile KI as a private citizen since 1989. He says his position comes from experience; Crane was diagnosed with thyroid cancer at age 26, more than 20 years after having his tonsils irradiated as a child in a Chicago hospital. He has battled the disease, which kills about 1,000 U.S. citizens annually, on and off for decades.

In 1989, when the NRC refused to change its opinion not to require KI stockpiling, Crane filed a professional opinion challenging that action. That was three years after the Chernobyl nuclear power plant accident, which resulted in about 900 cases of thyroid cancer, leaving many Soviet children with the "Belarussian necklace," a surgical scar that goes from ear to ear, says Crane. But in Poland, upwind of the accident, children were given KI pills, and there has been no increase in thyroid cancer. Also, in 1989 the World Health Organization recommended preventive distribution of KI, and, to date, France and Switzerland have distributed it widely.

But with one-fourth of the world's reactors, the United States has taken a conservative attitude. Despite a federal recommendation following the Three Mile Island accident in 1979 to stockpile KI, the NRC did not endorse the recommendation in 1985, and deadlocked on the issue again in 1994 after Crane urged reconsideration. One survey considered by NRC commissioners showed that 33 of 43 responding states opposed stockpiling, in part because they would have to develop plans to distribute the pills.

Nevertheless, in October 1996 the federal government agreed to buy KI for any state that wanted it. Additionally, plans were made to stockpile KI in 27 metropolitan areas and three national stockpiles. To date, three city stockpiles exist but plans to move the medicine to accident sites do not.

Now Crane wants the NRC to change its language to say stockpiling is "reasonable and prudent" and that states should consider it. His petition was published in the Federal Register in December for public comment and is expected to be voted on by the NRC after February. Unglesbee says the industry will oppose the measure, as it always has. He says that requiring states to consider KI constitutes "an unfunded federal mandate" on states that have already decided that KI pills "work against more effective evacuation."

But not all states feel that way. Tennessee and Alabama already stockpile KI at emergency centers, and in December, Maine's radiation advisory committee recommended stockpiling. Their endorsement came after strong testimony that portions of the evacuation plan for the area surrounding the Maine Yankee nuclear reactor in Wiscasset, Maine, failed during a test. This reactor, the state's only nuclear plant, has since been closed.

Crane feels that the NRC will eventually endorse stockpiling. "It's a matter of people finding out about it just as they did in Maine," he says. And what if the NRC votes his petition down? Well, he says, he can always ask for a judicial review.

Medical insurance? A current debate considers whether stockpiling potassium iodide near nuclear reactors offers a safeguard or a false sense of security.

Gamma Groceries

Highly publicized incidents last year, such as the recall by Hudson Foods, a Nebraska meat processor, of millions of pounds of hamburger contaminated with the potentially deadly bacteria *Escherichia coli* O157:H7, have made food safety a major concern in the United States. According to the Council for Agricultural Science and Technology, a nonprofit organization composed of 30 scientific societies, harmful bacteria carried in food can cause as many as 9,000 deaths annually.

In December, the FDA approved the use of ionizing radiation to kill harmful microorganisms in red meat as one more tool to protect the food supply. (The federal government had previously approved irradiation for poultry and fresh fruits and vegetables.) The move, which allows but does not require meat processors to irradiate meat, pleased food scientists and public health officials but worried some public interest and activist groups.

A prime irradiation target is ground beef, which can be laden with pathogens when contaminated carcasses are ground to make hamburger, says Michael Doyle, director of the Center for Food Safety and Quality Enhancement at the University of Georgia in Athens. Irradiating meat is a fairly simple process in which packaged meat is subjected to ionizing radiation—either gamma rays from radioactive materials such as cobalt 60 or cesium 137 or high energy electrons.

Though the U.S. Department of Agriculture has not drawn up rules to describe in detail how the process will work—it's estimated that rule development will take about a year—food scientists envision it occurring at the end of the packing process, just before the meat is shipped from the plant to retail stores. "It will make meat at the point of purchase at least 90% safer than it is today," says Curtis Melton, a professor of food science at the University of Tennessee in Knoxville.

Dennis Buege, a professor of animal science at the University of Wisconsin in Madison, says irradiation will increase ground beef's shelf life. "Rather than your package of ground beef staying in your refrigerator in good condition for three days, it may stay in good condition for six days," he says. Irradiation may also be particularly important in nursing homes and other institutional settings, where food safety is a major concern because food is prepared for relatively large numbers of people, says Buege.

Zapped for safety. Advocates say that irradiating food offers real protection against microbes, but some still worry about the safety of the procedure.

Irradiation will pasteurize, not sterilize, meat, say food safety specialists. The growth of harmful bacteria, such as Salmonella, Campylobacter, and *E. coli* O157:H7, and other microorganisms that spoil food but pose no harm will be sharply retarded because there will be fewer of them.

Irradiation is by no means the final answer to food safety concerns, however, experts say. "It's a complement to the other practices. The more safety barriers you have, the less likely you're going to have an unsafe product," says George Pauli, director of the division of product policy at the FDA's Center for Food Safety and Applied Nutrition in Washington, DC. Pauli and other authorities emphasize that irradiation doesn't relieve consumers from their responsibility in handling food safely. While he cannot cite exact figures, Morris Potter, an epidemiologist with the CDC says irradiation should "vastly improve the level of food safety."

Critics, however, claim that food irradiation is not necessary and may even harm food. Michael Jacobson, executive director of the Center for Science in the Public Interest, a nonprofit education and advocacy organization in Washington, DC, said in a 2 December 1997 statement issued by the center that there are other, cheaper methods, such as steam pasteurization, to make sure foods are safe. In the statement, he objected to the expected added expense of several cents per pound to cover the cost of irradiation equipment, ad added that "the meat and poultry industry should invest in new technologies that create clean products with less expense."

Food and Water, Inc., a Vermont-based activist group, argues that irradiation lowers the nutritional value of meats. Food specialists agree, but counter that the loss is no greater than when meat is cooked. Food and Water also questions the safety of the radiation process, arguing that it may cause illnesses and chromosome damage in those that eat it. But Pauli dismisses that possibility. He says the FDA approved irradiation under a legal standard that it would cause no harm, according to "competent scientists."

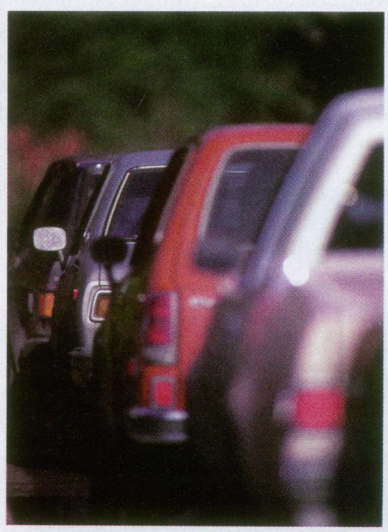
How irradiated meat will fare at the counter is uncertain. Opponents and proponents each have polls supporting their view on whether the public approves or disapproves. But consumers will know what they are getting, since a label indicating the meat has been irradiated must appear on the package. The label, however, is too small, according to Food and Water.

In the meantime, there will be efforts to make sure that conditions are optimal for meat irradiation, notes Doyle. One problem to be solved is to make sure "off" flavors don't develop. "The fattier the food, the more likely it is that off flavors will develop," he notes. He also points out that ground beef, which can be 20–30 % fat, may pose a challenge.

Genes and Ozone

New research suggests that whether or not a person reacts to toxic levels of ozone in the air depends upon their genes. If the animal studies that support this association are confirmed in humans, this newest example of the interaction between genes and the environment could have untold implications for industry, insurance, and health.

Researchers believe that knowing they are susceptible could help people protect themselves on bad ozone days, and they hope that clinical genetic therapies might also eventually be developed. Others say information on susceptibility could lead to stricter government regulation of air quality to reduce nitrogen oxides from car exhausts, which combine with oxygen and sunlight to form ozone.



Ozone culprits. New research shows that not just exposure but also genetics may play a role in susceptibility to the effects of ozone created when sunlight and oxygen mix with auto exhaust.

Yet another view is that such information could create a subpopulation of people at risk for discrimination on the basis of their genetic makeup. "It could be a sticky issue if the gene ran in certain ethnic or racial groups, or if disclosure of the gene could risk insurance coverage," says pulmonologist Jeffrey Drazen of the Harvard Medical School in Cambridge, Massachusetts.

"This could become quite a societal issue," acknowledges Steven Kleeberger, one of the scientists who reported the link in the December 1997 issue of *Nature Genetics*. Kleeberger, a researcher at the Johns Hopkins University department of environmental health sciences, predicts that, given genetic susceptibility, the health effects of ozone will become even more of a regulatory and political issue in the future. The findings of Kleeberger's research, along with those of a second study by George Leikauf and colleagues from the University of Cincinnati that were published in the same issue, move the field of air pollution genetics solidly forward. Now, scientists don't talk about if such susceptibility genes are identified in humans, but when.

Both studies used strains of inbred mice with differing responses to ozone. Kleeberger's team selected one strain of mice that was resistant to ozone and one strain that was very responsive. They crossbred the groups, then bred the groups' offspring to select for expression of genes on chromosome 11 and chromosome 17 that control responsivity to ozone. The Cincinnati researchers also found a locus on chromosome 11 that broadly overlapped with Kleeberger's area, indicating the two teams may be honing in on the same gene.

There was significant activity in the segment on chromosome 17, and in searching the mouse genome database for this chromosome, Kleeberger and his team identified several candidate genes that may be causing the activity. One, the tumor necrosis factor alpha (*TNF-α*) gene, seems a highly logical candidate, Kleeberger says. TNF is a pro-inflammatory cytokine that influences genes in the immune response cascade. To test their hypothesis, Kleeberger's team treated the susceptible strain of mice with antibodies that